LISTING OF CLAIMS

1. (Currently Amended) A method of analysis of an array image including one or more luminous spots on a background, comprising:

determining a shape and ~~relative~~ location of each spot on the array image;

generating a binary map of pixels defining a boundary of each spot on the background;

isolating each spot from the background by an extraction operation using said binary map;

examining each spot by a segmentation operation to identify pixels belonging to a same cluster according to a preestablished criterion; and

for each spot, defining relative characteristic parameters and quality indexes determined in function of gray levels of pixels of the spot;

wherein said binary map is generated with a technique of morphological filtering comprising:

filtering the array image with at least a morphological filter generating a corresponding marker ~~"marker"~~ image of the background;

determining a ~~reconstructing said~~ background level by carrying out a reconstruction operation on said marker ~~"marker"~~ image to generate a corresponding reconstructed image of the background; and

generating a filtered image from which ~~of~~ the luminosity of the background is removed by performing a top-hat operation on said reconstructed background image and the array image; and performing a thresholding operation on said filtered image of the background luminosity.

2. (Original) The method of claim 1, wherein said reconstruction operation is carried out using circular masks.

3. (Currently Amended) The method of claim 2, further comprising filtering ~~of~~ the noise corrupting said binary map by:

carrying out in succession two erosion operations using circular masks of different ratios ~~radios~~;

carrying out a dilation operation using a circular mask of diameter larger than the maximum dimensions of the spot,

generating a binary map filtered from noise; and

using said binary map filtered from noise in said extraction operation.

4. (Currently Amended) The method of claim 1, wherein ~~the spots of a~~ said marker ~~"marker"~~ image is ~~are~~ generated by:

defining on a Cartesian reference frame spots present in the array image;

carrying out in succession the following morphological filtering operations of said spots with directional openings having as structuring sets ~~said~~ segments of length not larger than the maximum dimension of the spots and oriented, respectively, along:

the bisecting line of the first and third quadrant;

the bisecting line of the second and fourth quadrant;

the abscissa axis; and

the ordinate axis;

of said Cartesian reference frame ~~generating spots on a corresponding "marker" image~~.

5. (Currently Amended) The method according to claim 1, wherein said extraction operation comprises:

scanning ~~(General Clustering)~~ pixels of an image by column or by row, associating to adjacent pixels scanned in succession and corresponding to pixels of the relative binary map having the same logic active value a quadruplet defining an elementary cluster composed of an identification number ~~(index)~~, minimum ~~(xmin)~~ and maximum ~~(xmax)~~ coordinates and number ~~(y)~~ of column or of row;

identifying ~~(Merge1)~~ for each elementary cluster ~~(index=C)~~ in a certain column or row ~~(i+1)~~ a set of elementary clusters ~~(S)~~ in the column or row immediately preceding ~~(i)~~ bordering said elementary cluster ~~(index=C)~~;

identifying in said set of elementary cluster ~~(S)~~ a winner cluster ~~(index=W)~~ having the largest number of boundary pixels with said elementary cluster ~~(index=C)~~ and the remaining clusters as losers, and making the identification number of said elementary cluster equal to the identification number of said winner cluster;

making ~~(Merge2)~~ the identification number of each of the loser clusters equal to the identification number of the respective winner cluster; and

selecting pixels of luminous spots ~~(Cluster Sorting, Cluster Extraction)~~ by extracting from the original image pixels of clusters having the same identification number.

6. (Original) The method of claim 1, wherein said preestablished criterion of segmentation comprises calculating a characteristic value for pixels of a spot by a fuzzy logic algorithm comprising:

calculating for said spot the mean value of grey level of the background pixels, said fuzzy logic algorithm using as antecedents:

the grey level of a pixel;

the distance between said grey level of the pixels and the mean grey level of the background pixels; and

the square of said distance; and

recognizing said pixels as belonging to a same cluster if said characteristic value exceeds a preestablished threshold.

7. (Currently Amended) The method of claim 6, further comprising: defining by said preset criterion for each spot a first zone ~~(True Signal)~~ containing signal pixels and a second zone ~~(false signal)~~ containing background and/or noise pixels.

8. (Original) The method of claim 6, wherein each antecedent has three membership functions.

9. (Original) The method of claim 8, wherein said membership functions are Gaussian functions having preset mean and variance.

10. (Original) The method of claim 6, wherein said fuzzy logic algorithm has five consequents.

11. (Currently Amended) The method of claim 6, wherein said segmentation operation comprises:

scanning (General Clustering) pixels of an image by column or by row, associating to adjacent pixels scanned in succession and corresponding to pixels of the relative binary map having the same logic active value a quadruplet defining an elementary cluster composed of an identification number ~~(index)~~, minimum ~~(xmin)~~ and maximum ~~(xmax)~~ coordinates and number ~~(y)~~ of column or of row;

identifying ~~(Merge1)~~ for each elementary cluster ~~(index=C)~~ in a certain column or row ~~(i+1)~~ a set of elementary clusters ~~(S)~~ in the column or row immediately preceding ~~(i)~~ bordering said elementary cluster ~~(index=C)~~;

identifying in said set of elementary cluster ~~(S)~~ a winner cluster ~~(index=W)~~ having the largest number of boundary pixels with said elementary cluster ~~(index=C)~~ and the remaining clusters as losers, and making the identification number of said elementary cluster equal to the identification number of said winner cluster;

making ~~(Merge2)~~ the identification number of each of the loser clusters equal to the identification number of the respective winner cluster; and

selecting pixels of luminous spots ~~(Cluster Sorting, Cluster Extraction)~~ by extracting from the original image pixels of clusters having the same identification number.

12. (Currently Amended) The method of claim 7 comprising calculating for each spot characteristic parameters and quality indexes belonging to the group consisting of

the mean value of the grey levels of the pixels of said first zone ~~(True Signal)~~;

the coordinates of the center of gravity of the spot;

the mean value of the grey levels of the border pixels of the spot;

the median of the grey levels of said first zone ~~(True Signal)~~;

the median of the grey levels of said border pixels of the spot;

the ratio between height and width of the smallest rectangle containing said first zone ~~(True Signal)~~;

the number of pixels composing the spot;

the number of border pixels of the spot;

the number of pixels of said first zone ~~(True Signal)~~;

a normalization factor of the grey levels of the pixels equal to the difference between the median of the grey levels of the pixels of said first zone ~~(True Signal)~~ and the median of the grey levels of the border pixels of the spot; and

the mean value ~~(FOMV)~~ of said characteristic value for the pixels of said first zone ~~(True Signal)~~.

13. (Currently Amended) A device for the analysis of array images comprising an array localization system having the architecture of a cellular neural network for processing the pixels of luminous spots ~~said spot~~ and implementing the following operations:

determining a shape and ~~relative~~ location of each spot on the array image;

generating a binary map of pixels defining a boundary of each spot on the dark background;

isolating each spot from the background by an extraction operation using said binary map;

examining each spot by a segmentation operation to identify pixels belonging to a same cluster according to a preestablished criterion; and

for each spot, defining relative characteristic parameters and quality indexes;

wherein said binary map is generated with a technique of morphological filtering comprising:

i) filtering the array image with at least a morphological filter generating a corresponding marker ~~"marker"~~ image of the background;

ii) determining a ~~reconstructing said~~ background level by carrying out a reconstruction operation on said marker ~~"marker"~~ image to generate a corresponding reconstructed image of the background;

iii) generating a filtered image from which ~~of~~ the luminosity of the background is removed by performing a top-hat operation on said reconstructed background image and the array image; and

iv) performing a thresholding operation on said filtered image of the background luminosity.

14. (Currently Amended) The device of claim 13, having a spot extraction system for isolating luminous spots on a background of an array image, comprising:

a scanning subsystem ~~(Extractor)~~ of the pixels of an image;

a subsystem ~~(Features Extractions, Clustering Conditions)~~ of identification of elementary clusters composed of adjacent pixels scanned in succession implementing the spot extraction operation; and

a subsystem ~~(Clustering)~~ of processing of said elementary clusters outputting clusters of pixels ~~(Cluster 1, ..., Cluster N)~~ present in the spot.

15. (Currently Amended) The device of claim 14, having an intra-spot segmentation system of luminous spots on a background of an image, comprising:

a scanning subsystem ~~(Extractor)~~ of pixels of a spot; and

a fuzzy logic processing subsystem coupled to said scanning subsystem, discriminating the scanned pixels in signal pixels and background or noise pixels.

16. (Currently Amended) The device of claim 15, wherein said fuzzy logic processing subsystem implements an ~~and~~ intra-spot segmentation operation and comprises:

a subsystem ~~(Features Extraction, Clustering Condition)~~ defining elementary clusters composed of adjacent pixels, and further comprising a processing subsystem ~~(Clustering)~~ of said elementary cluster that outputs clusters of pixels ~~(Cluster 1, ..., Cluster N)~~ found in said spot.

17. (Original) A method of identification of the pixels of an image belonging to a same object on a background, comprising:

scanning the pixels of said image;

calculating a characteristic value for each scanned pixel by a fuzzy logic algorithm having as antecedents:

the grey level of the pixel,

the distance between said grey level of the pixel and the mean grey level of background pixels, and

the square of said distance;

calculating the mean value of grey level of the background pixels; and

defining a pixel as belonging to a same object if said characteristic value exceeds a preestablished threshold.

18. (Original) The method of claim 17, wherein each antecedent has three membership functions.

19. (Original) The method of claim 18, wherein said membership functions are Gaussian functions of preset mean and variance.

20. (Original) The method of claim 17, wherein said fuzzy logic algorithm has five consequents.

21. (Original) A method of segmentation of luminous spots on a background of an array image for identifying pixels of objects represented in a spot from background or noise pixels, comprising:

examining each spot by:

scanning the pixels;

calculating a characteristic value for each scanned pixel by a fuzzy logic algorithm having as antecedents:

the grey level of the pixel,

the distance between said grey level of the pixel and the mean grey level of background pixels, and

the square of said distance;

calculating the mean value of grey level of the background pixels; and

defining a pixel as belonging to the spot if said characteristic value exceeds a preestablished threshold.

22. (Currently Amended) The method of claim 21, comprising:

scanning ~~(General Clustering)~~ pixels of an image by column or by row, associating to adjacent pixels scanned in succession and corresponding to pixels of the relative binary map having the same logic active value a quadruplet defining an elementary cluster composed of an identification number ~~(index)~~, minimum ~~(xmin)~~ and maximum ~~(xmax)~~ coordinates and number ~~(y)~~ of column or of row;

identifying ~~(Merge1)~~ for each elementary cluster ~~(index=C)~~ in a certain column or row ~~(i+1)~~ a set of elementary clusters ~~(S)~~ in the column or row immediately preceding ~~(i)~~ bordering said elementary cluster ~~(index=C)~~;

identifying in said set of elementary cluster ~~(S)~~ a winner cluster ~~(index=W)~~ having the largest number of boundary pixels with said elementary cluster ~~(index=C)~~ and the remaining clusters as losers, and making the identification number of said elementary cluster equal to the identification number of said winner cluster;

making ~~(Merge2)~~ the identification number of each of the loser clusters equal to the identification number of the respective winner cluster; and

selecting pixels of luminous spots ~~(Cluster Sorting, Cluster Extraction)~~ by extracting from the original image pixels of clusters having the same identification number.

23. (Currently Amended) The method of claim 21, wherein said segmentation operation comprises defining by said preset criterion for each spot a first zone ~~(True Signal)~~ containing signal pixels and a second zone ~~(false signal)~~ containing background and/or noise pixels.

24. (Currently Amended) The method of claim 23, comprising calculating for each spot characteristic parameters and quality indexes belonging to the group consisting of:

the mean value of the grey levels of the pixels of said first zone ~~(True Signal)~~;

the coordinates of the center of gravity of the spot;

the mean value of the grey levels of the border pixels of the spot;

the median of the grey levels of said first zone ~~(True Signal)~~;

the median of the grey levels of said border pixels of the spot;

the ratio between height and width of the smallest rectangle containing said first zone ~~(TRUE SIGNAL)~~;

the number of pixels composing the spot;

the number of border pixels of the spot;

the number of pixels of said first zone ~~(True Signal)~~;

a normalization factor of the grey levels of the pixels equal to the difference between the median of the grey levels of the pixels of said first zone ~~(True Signal)~~ and the median of the grey levels of the border pixels of the spot; and

the mean value ~~(FOMV)~~ of said characteristic value for the pixels of said first zone ~~(True Signal)~~.

25. (Currently Amended) A method of analysis of array images in the form of one or more luminous spots on a dark background comprising the following steps:

determining shapes and ~~relative~~ locations of said spots ~~on a sensible area~~ of said array generating a binary of pixels defining boundaries of said luminous spots on the background;

generating a binary map of pixels defining a boundary of each spot on the background;

isolating each of said spots from the surrounding background by an extraction operation using said binary map;

examining each spot by a segmentation operation identifying pixels belong to a same cluster according to a pre-established criterion; and

for each of said spots defining relative characteristic parameters and quality indexes determined as a function of gray levels of pixels of the spot;

wherein the segmentation operation is carried out by:

examining each spot by:

scanning the pixels;

calculating a characteristic value for each scanned pixel by a fuzzy logic algorithm having as antecedents:

the grey level of the pixel,

the distance between said grey level of the pixel and the mean grey level of background pixels, and

the square of said distance;

calculating the mean value of grey level of the background pixels; and

defining a pixel as belonging to the spot if said characteristic value exceeds a preestablished treshold.

26. (Currently Amended) A system for identifying pixels of an image belonging to the same cluster on a background, comprising:

a scanning subsystem ~~(Extractor)~~ of the pixels of an image; and

a fuzzy logic processing subsystem coupled to said scanning subsystem identifying the scanned pixels as pixels belonging to a same object, by:

scanning the pixels of said image;

calculating a characteristic value for each scanned pixel by a fuzzy logic algorithm having as antecedents:

the grey level of the pixel,

the distance between said grey level of the pixel and the mean grey level of background pixels, and

the square of said distance;

calculating the mean value of grey level of the background pixels; and

defining a pixel as belonging to a same object if said characteristic value exceeds a preestablished threshold.

27. (Currently Amended) The system of claim 26, wherein said fuzzy logic subsystem comprises:

a subsystem ~~(Features Extractions, Clustering Conditions)~~ of identification of elementary clusters composed of adjacent pixels scanned in succession implementing the spot extraction operation; and

a subsystem ~~(Clustering)~~ of processing of said elementary clusters outputting clusters of pixels ~~(Cluster 1, ..., Cluster N)~~ present in the image.

28. (Currently Amended) The system of claim 27, wherein said subsystem ~~(Features Extractions, Clustering Conditions)~~ of identification of elementary clusters is a fuzzy logic system implementing a segmentation process.